

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.

The Examiner is respectfully requested to consider and enter the following amendments:

IN THE CLAIMS:

Please amend Claims 1-12 and 14, as follows:

1. (Amended) A diffractive optical element having [plural] a diffraction grating [surfaces accumulated, characterized in that: a pair of diffraction grating surfaces are positioned so that a protrusion and/or a recess formed on an outside of one diffraction grating surface engages with a recess and/or a protrusion formed on an outside of the other diffraction grating surface; and that the pair of diffraction grating surfaces are defined on materials having different refractive indices and different dispersions and being formed into a kinoform, or a shape and a height of blazed or binary, close to it,] portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second substrates are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the

alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a largest optical path difference to be applied to light rays passing through the diffraction grating [surfaces] portion with respect to each of plural wavelengths, becomes equal to a multiple, by an integral number, of the [wavelength] corresponding one of the plural wavelengths.

2. (Amended) A diffractive optical element having [plural] a diffraction grating [surfaces accumulated,

characterized in that: a pair of diffraction grating surfaces are positioned so that a protrusion and/or a recess formed outside an optically effective region of one diffraction grating surface engages with a recess and/or a protrusion formed outside an optically effective region of the other diffraction grating surface; and that the pair of diffraction grating surfaces are defined on materials having different refractive indices and different dispersions and being formed into a kinoform, or a shape and a height close to it,] portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are

C/
CONF
integrally formed on a second substrate, and that the first and second substrates are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a largest optical path difference to be applied to light rays passing through the diffraction grating [surfaces] portion with respect to each of plural wavelengths becomes equal to a multiple, by an integral number, of the [wavelength] corresponding one of the plural wavelengths, and the alignment patterns are formed outside optically effective regions of the first and second diffraction gratings.

3. (Amended) A diffractive optical element having [plural] a diffraction grating [surfaces accumulated, characterized in that: a pair of diffraction grating surfaces are positioned so that a protrusion and/or a recess formed on an outside of one diffraction grating surface engages with a recess and/or a protrusion formed on an outside of the other diffraction grating surface; and that the pair of diffraction grating surfaces are defined on materials having different refractive indices and different dispersions and being formed into a kinoform or a shape and a height close to it,] portion

which includes first and second diffraction gratings, the improvement residing in that:

C1
conf

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second substrates are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a diffraction efficiency of diffraction light of a particular order, [such as one of positive and negative first order,] with respect to each of plural wavelengths, becomes equal to or nearly equal to 100%.

4. (Amended) A diffractive optical element having [plural] a diffraction grating [surfaces accumulated, characterized in that: a pair of diffraction grating surfaces are positioned so that a protrusion and/or a recess formed outside an optically effective region of one diffraction grating surface engages with a recess and/or a protrusion formed outside an optically effective region of the other diffractive surface; and that the pair of diffraction grating

C1
C187A

surfaces are defined on materials having different refractive indices and different dispersions and being formed into a kinoform, or a shape and a height close to it,] portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second substrates are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a diffraction efficiency of diffraction light of a particular order, [such as one of positive and negative first order,] with respect to each of plural wavelengths, becomes equal to or nearly equal to 100%, and the alignment patterns are formed outside optically effective regions of the first and second diffraction gratings.

5. (Amended) A diffractive optical element according to any one of Claims 1-4, wherein the [pair of] first and second diffraction gratings are disposed opposed to each other [with a space such as by an air interposed therebetween].

6. (Twice Amended) A diffractive optical element according to any one of Claims 1-4, wherein the [protrusion and the recess] alignment patterns have a sectional shape of one of a [triangle] triangular shape, a trapezoidal shape and a semi-circular shape.

7. (Amended) A diffractive optical element having [plural] a diffraction grating [surfaces accumulated, characterized in that: a pair of diffraction grating surfaces are mutually positioned so that a protrusion and/or a recess having a sectional shape of one of a triangular shape, a trapezoidal shape, and a semi-circular shape, formed on one diffraction grating surface, engages with a recess and/or a protrusion having a sectional shape of one of a triangular shape, a trapezoidal shape, and a semi-circular shape, formed on the other diffraction grating surface] portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second substrates are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the

alignment pattern on the second substrate,

wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape.

C1
cont

8. (Amended) A diffractive optical element having [plural] a diffraction grating [surfaces accumulated, characterized in that: a pair of diffraction grating surfaces are mutually positioned so that a protrusion and/or a recess having a sectional shape of one of a triangular shape, a trapezoidal shape, and a semi-circular shape, formed outside an optically effective region of one diffraction grating surface engages with a recess and/or a protrusion having a sectional shape of one of a triangular shape, a trapezoidal shape, and a semi-circular shape, formed outside an optically effective region of the other diffraction grating surface] portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second substrates are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the

alignment pattern on the second substrate,

wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape, and the alignment patterns are formed outside optically effective regions of the diffraction gratings.

9. (Twice Amended) A method of manufacturing a diffractive optical element as recited in any one of Claims 1-4, 7 and 8, characterized by a process for fitting the [protrusion as formed on the one diffraction grating into the recess as formed on the other diffraction grating] the alignment patterns of the first and second substrates together.

10. (Twice Amended) A method of manufacturing a diffractive optical element as recited in any one of Claims 1-4, 7 and 8, characterized by a process in which, after [one diffraction grating surface] the first substrate is formed, [another diffraction grating surface] the second substrate is formed by use of a mold, wherein [a protrusion and/or a recess formed on the one diffraction grating surface] the alignment pattern of the first substrate is fitted into [a recess and/or a protrusion] the alignment pattern of the second substrate formed on the mold for [the other diffraction grating surface] the second substrate, whereby [these diffraction grating

surfaces] the first and second substrates are mutually positioned and molding of the [other diffraction grating surface] second substrate is performed.

12
11. (Amended) A method of manufacturing a diffractive optical element, comprising the steps of:

forming, upon a substrate, a first diffraction grating pattern and [a recess and/or a protrusion] an alignment pattern;

preparing a mold having [a protrusion and/or a recess] (i) an alignment pattern to be engaged with the [recess and/or the protrusion] alignment pattern formed on the substrate, [as well as] and (ii) a second diffraction grating pattern; and

positioning the first diffraction grating pattern on the substrate and the second diffraction grating pattern to be spaced with respect to each other by engaging the [recess and/or the protrusion] alignment pattern of the substrate with the [protrusion and/or the recess] alignment pattern of the mold.

13
12. (Amended) An optical system having a diffractive optical element as manufactured in accordance with [a] the method [as] recited in Claim 11.